**Hrvoje Kušić, short CV**

Prof. Hrvoje Kušić is born in Zagreb, Croatia. He is employed at the University of Zagreb, Faculty of Chemical Engineering and Technology as Associate Professor, and currently is a Vice-dean for Research and International Collaboration. He received a Diploma (B.Sc./M.Sc.) in Chemical Technology from University of Zagreb, Faculty of Chemical Engineering and Technology, while the Ph.D. degree in Chemical Engineering was received from the same institution in 2006.

He is head of research group on advanced oxidation technologies and solar-active materials, while his research interests include: (i) advanced oxidation technologies for water treatment, particularly (photo)Fenton processes, persulfate based processes, and photocatalysis; (ii) nanotechnology, particularly design and development of solar-active materials for water treatment and energy conversion; (iii) process simulation and optimization including mechanistic/phenomenological modeling; (iv) fate and behavior of contaminants of emerging concern using QSA/PR modeling; (v) waste management, particularly thermal treatment technologies; and from recently, (vi) microplastics.

He is recipient of *National Annual Science Award* for 2011 from Ministry of Science, Education and Sports of the Republic of Croatia for his outstanding scientific research performance. He teaches courses on water quality and treatment, waste management, advanced oxidation technologies, and risk assessment. Besides pedagogic work, he is currently involved in several research projects, mainly on solar photocatalysis; participate(d) in 11 (4 as PI) national and 6 (2 as PI) international projects. He is (co)author of >90 publications (including >70 papers in peer-review journals and several books/book chapters) and holds >2000 citations, and participated at >70 national and international conferences, including several plenary and invited lectures. Prof. Kusic has served as a member of Scientific and Organizing Boards of several scientific conferences and is a member of numerous international and national (both scientific and professional) societies and federations. He is/was also associate editor in several journals: *Chemical Engineering Journal* (2020-), *Journal of Nanotoxicology and Nanomedicine* (2015-), *Journal of Advanced Oxidation Technologies* (2016-2018), and serves as regular reviewer for numerous peer-reviewed journals (>120 articles reviewed for 27 journals).

**Summary of presentation:**

Accessible energy resources and clean water are nowadays among the highest priorities sustaining economic growth and societal wellbeing. Although the interdependency of energy and water is well known, the related technologies are still not sufficiently integrated. The groundbreaking idea within ongoing current projects is to produce the clean energy while cleaning the water and also utilizing waste materials for those purposes, thus closing waste-water-energy and creating the shift of water-energy nexus paradigm. The underlying mechanism of photocatalytic processes for water purification and photoelectrochemical processes for energy conversion is basically the same. Both $H_2$ production by water splitting and photocatalytic degradation of organic pollutants in water rely on the formation of electron/hole ($e^-/h^+$) pairs at a semiconducting material upon its excitation by the light with sufficient photon energy. The main goal is to develop novel nano-sized catalyst material(s) (NCM) tailored to effectively harvest solar irradiation for simultaneous/sequential solar driven water purification and $H_2$ production. The idea is to use semiconducting composites, coupled of $TiO_2$ and semiconducting materials (e.g. $SnS_2$, $BiVO_4$, and $\alpha$-$Fe_2O_3$), and graphene oxide and its reduced form (GO/rGO) made by biochar, a solid residue of biomass pyrolysis. The utilization of such materials in solar-driven processes target treatment of water polluted by pharmaceuticals, and it is anticipated that their byproducts (low C-atom species) may mimic the role of lower C-atom alcohols (commonly used in $H_2$ production in sole water splitting). The optimization and evaluation of solar/NCM system effectiveness, comprehending ecological, energetic and economic aspects will be performed integrating modeling and experimental approaches. The performance of NCM will be tailored through the planed design and development procedures. Fine tuning of the particular properties will be assisted by modeling at the molecular scale, thus minimizing the risk of the failure. Hence, the projects results

will address both water and energy fields and pave the way toward the application of innovative, clean and sustainable technologies.